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THE GENUS *POA* IN COOK COUNTY, MINNESOTA*

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Plates 1051 and 1052

As a result of over twenty years of botanizing in Cook County¹, a considerable number of specimens of the genus *Poa* have accumulated at the Herbarium of the University of Minnesota. A relatively small number of these belong to easily recognized species, but by far the largest share belong to the exceedingly complicated *P. glauca*—*P. nemoralis* group.

The flora of Cook County, the extreme northeastern county in the state of Minnesota, contains many plants of interesting affinities, some definitely arctic-alpine, some Cordilleran, and some related to the group of species centering about the Gulf of St. Lawrence.² In view of this, and of the difficulties that became apparent as soon as we attempted to make a preliminary identification of our material, it seemed worth while to make an intensive study of all the specimens of *Poa* in the Herbarium of the University of Minnesota from this part of the state³. As a

* Contributions from the Herbarium of the University of Minnesota, II. Unless otherwise indicated, all specimens cited are in this herbarium.

¹ The botanical exploration of Cook County has been greatly assisted since 1938 by grants-in-aid received from the Graduate School of the University of Minnesota.

² Some of these points have been mentioned in passing in earlier papers:

F. K. BUTTERS, Hybrid Woodsias in Minnesota. *Amer. Fern Jour.* 31: 15-21. 1941.

F. K. BUTTERS AND E. C. ABBE, A New Oxytrope of the Minnesota-Ontario Border. *RHODORA* 45: 1-4. 1943.

F. K. BUTTERS, The American variety of *Saxifraga aizoon*. *RHODORA* 46: 61-69. 1944.

³ In this study we have been greatly aided by the loan of a considerable suite of specimens from the Gray Herbarium, mainly from northeastern North America, which had been annotated by Professor Lindman after the completion of his monographic

result of this study we have extended the range of several of the races of this group of grasses, have noted one hybrid which seems to be confined to the area in question, and have been constrained to describe one new species.

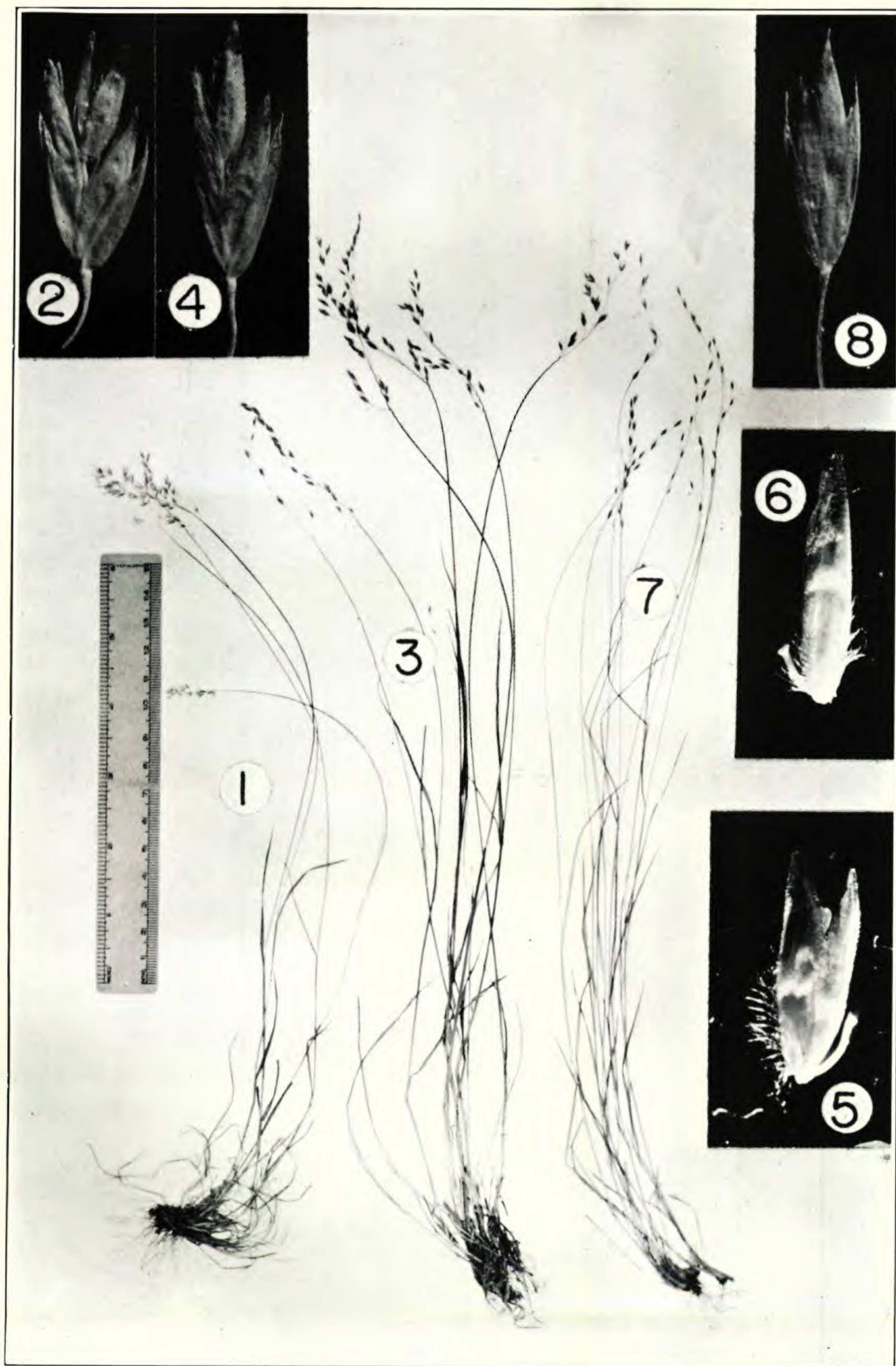
After the completion of the first draft of this paper and of a flora of Cook County, the writers made an extended trip through Cook County during the summer of 1944 checking the information which had been collected through previous field and herbarium work. Relatively few modifications in taxonomic concepts resulted, other than a strengthening of our conviction that our new species is indeed a natural entity, and the correction and amplification of notes on frequency and habitat of other species.

We frankly acknowledge that in several respects the following treatment is tentative. The inaccessibility of all European types at the present time prevents us from reaching definitive conclusions in several cases. However, it seems worth while to put on record our present findings. For the sake of completeness we have entered in the following key all the species of *Poa* known to us from the county, and have made brief comments on their distribution in the county even when they appear to offer no particular taxonomic difficulties.

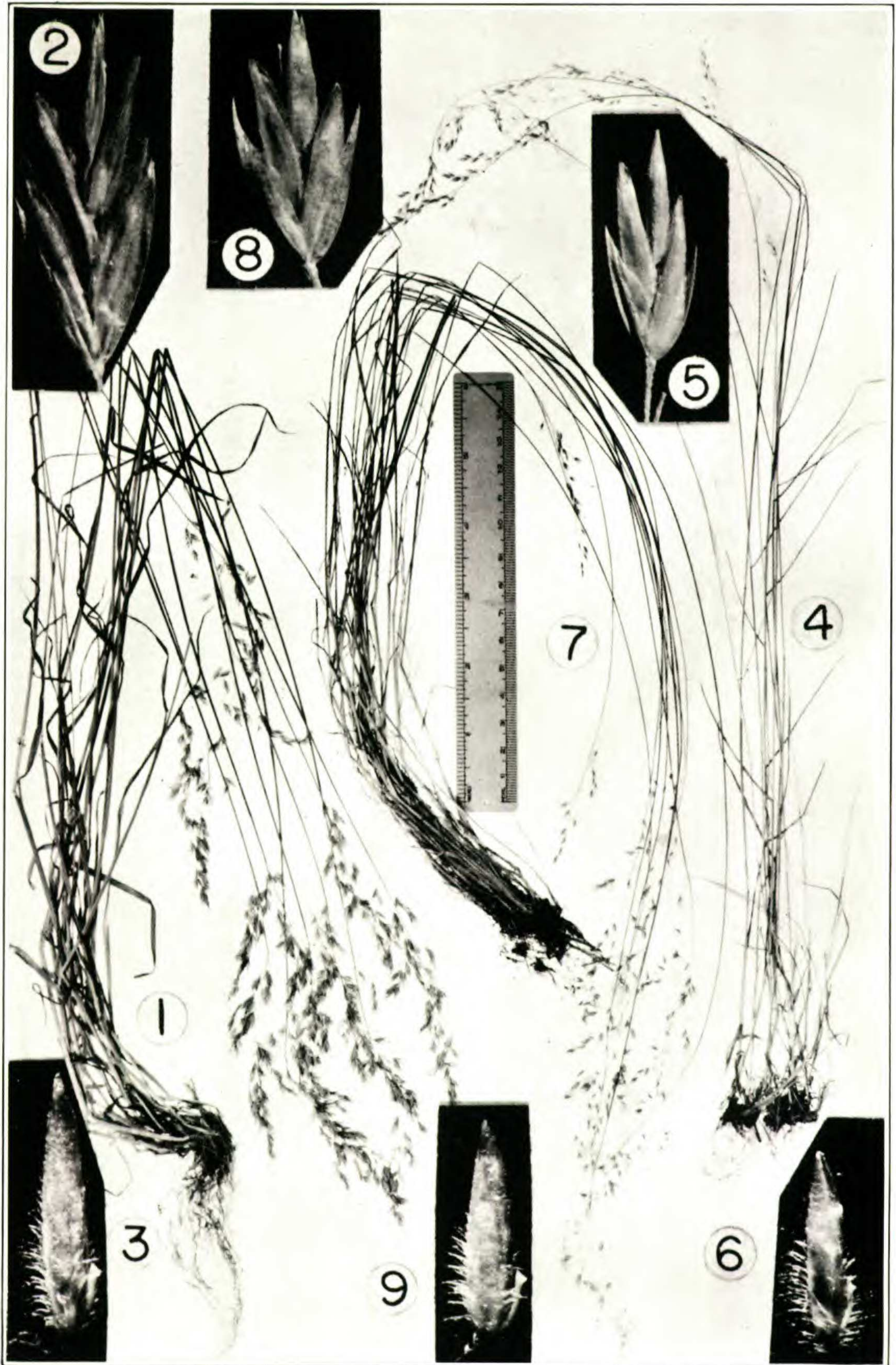
KEY TO THE SPECIES OF POA KNOWN TO GROW IN COOK CO., MINN.

- A. Annual (often a winter-annual) *P. annua*.
- B. Perennials.
 - 1a. Creeping rhizomes present
 - 2a. Stem nearly round, culms in bunches *P. pratensis* (sens. lat.).
 - 2b. Stem flattened, culms not in bunches *P. compressa*.
 - 1b. Creeping rhizomes absent, but the innovations sometimes growing horizontally for a few centimeters and occasionally rooting.
 - 3a. Lemmas glabrous, including the keel, except for a well-developed web at the base; panicle open, the branches mostly in 2's and 3's *P. saltuensis*.
 - 3b. Lemmas pubescent on the keels and marginal nerves, web at the base variously developed, often very scanty.
 - 4a. Plants loosely tufted, the innovations mostly extravaginal, often growing out for a few centimeters before they bend upward to form new culms; empty glumes with a green opaque center and white, scarious, translucent margins or frequently more or less suffused with purple which may conceal this pattern (in the latter case the anthocyanin may readily be removed by boiling); end of palea rather acute, the keels converging, covered with crowded, unequal, short teeth.

work on this genus in Scandinavia. For this loan we extend our grateful acknowledgment to Professor M. L. Fernald.



POA SCOPULORUM: FIGS. 1, 3 and 7, habit, $\times \frac{1}{3}$; FIGS. 2, 4 and 8, spikelets, $\times 6$; FIGS. 5 and 6, florets, $\times 8$.



POA GLAUCA, subsp. *GLAUCANTHA*: FIG. 1, habit, $\times \frac{1}{3}$; FIG. 2, spikelet, $\times 6$; FIG. 3, floret, $\times 8$.

P. NEMORALIS, var. *INTERIOR*: FIG. 4, habit, $\times \frac{1}{3}$; FIG. 5, spikelet, $\times 6$; FIG. 6, floret, $\times 8$.

\times *P. TORMENTUOSA*: FIG. 7, habit, $\times \frac{1}{3}$; FIG. 8, spikelet, $\times 6$; FIG. 9, floret, $\times 8$.

- 5a. Primary culms mostly tall (3 dm. or more), culm with 5(-7) nodes, leafy to above the middle.⁴
- 6a. Ligule 2-3 mm. long; culms usually stout, often markedly geniculate at the base; panicle usually open and large with abundant tertiary branching and many spikelets; lemmas smooth, neat-looking, tending to be firm, not thin-edged. *P. palustris*.
- 6b. Ligule less than 2 mm. long, sometimes nearly absent; culms usually slender, curved or geniculate at the base; panicle open and narrowly pyramidal to contracted and spike-like, tertiary branching absent or infrequent and spikelets sometimes very few; lemmas thin-edged and sometimes erose toward the tip, tending to be membranaceous. (*P. nemoralis*, sens. lat.).
- 7a. Ligule absent or very short (rarely as much as 1 mm. long); empty glumes long (the second as long as the first lemma) and very narrow and straight (awl-shaped), very acuminate (almost bristle-tipped); panicle large (5-25 cm. long), narrowly lanceolate with numerous spikelets and branches, somewhat open at maturity; spikelets predominantly green, occasionally slightly purple and somewhat yellow-tipped; empty glumes with distinct white margins
P. nemoralis (typical).
- 7b. Ligule usually 1 mm. or more long; empty glumes shorter and broader than in 7a, short-acuminate to acute, the second rarely equalling the first lemma; panicle smaller than in 7a, open or contracted at maturity, the basal branches mostly 2 or 3.
- 8a. Spikelets green, rarely with a tinge of purple; glumes with a wide, scarious (usually white) margin and a green center, acute, the lateral nerves evident; habit loose, leaves flat and flexible, ligules very rough
P. nemoralis, var. *interior*.
- 8b. Spikelets usually purple; empty glumes with little or no white margin, acuminate; habit rather stiff, leaves flat or conduplicate, not flexible. *P. nemoralis*, var. *montana*.
- 5b. Primary culms with 3(-4) nodes, the uppermost leaf borne below the middle of the culm⁵. (*P. glauca* sens. lat.).
- 9a. Plant stiffly erect, mostly under 3 dm. high; culms and cauline leaves stiff, the uppermost leaf 2-5 cm. long; spikelets mostly strongly colored with purple; glumes nearly equal.
- 10a. Plant mostly 2-3 dm. high; panicle rather loose; spikelets 3-4 mm. long. *P. glauca* (typical).
- 10b. Plant mostly lower; panicle crowded and almost spike-like; spikelets very dark, about 4-5 mm. long. *P. glauca*, subsp. *conferta*.

⁴ For clusters of dwarf secondary culms leafy nearly to the top see footnote 5.

⁵ In certain specimens (apparently diseased) of *P. glauca*, subsp. *glaucantha* large tufts of dwarf (1-2 dm.) secondary culms, leafy almost to the inflorescence, arise late in the summer. In the absence of primary culms these might be sought under 5a.

- 9b. Culms mostly tall (3–8 dm., rarely lower in depauperate individuals), geniculate below and arcuate above; cauline leaves soft; spikelets greenish or only lightly tinged with purple; glumes distinctly unequal.
- 11a. Culine leaves mostly 5–8 cm. long and about 2 mm. wide; culms coarse; spikelets (4–) 5–7 mm. long, some of them nearly sessile; plant usually fruiting freely. *P. glauca*, subsp. *glaucantha*.
- 11b. Culine leaves mostly 4–6 cm. long, scarcely 1 mm. wide; culms very fine and arcuate; spikelets about 4 mm. long, pedicelled; plant nearly sterile. × *P. tormentuosa*.
- 4b. Plants densely tufted, the innovations intravaginal; empty glumes translucent throughout, without a conspicuously green center, and with no anthocyanin; end of the palea truncate and erose, the keels nearly parallel, pectinate, the chief teeth rather long and widely spaced. *P. scopulorum*.

P. ANNUA L. POPLAR LAKE, *Butters and Abbe* 963. Near habitations; introduced weed. Less common in Cook County than in many parts of Minnesota.

P. PRATENSIS L., sens. lat. BRULE RIVER, *Butters & Rosendahl* 4526. Gravelly beach; rare, perhaps native.

While *P. pratensis* sens. lat. is undoubtedly the commonest grass in Minnesota, it is comparatively scarce in Cook County, and is almost entirely confined to obviously disturbed areas (roadsides, camp-grounds, etc.) where it presumably represents a recent introduction. The commonest form, as elsewhere in the state, is var. *angustifolia* (L.) Sm., but the above cited collection is quite unlike this form. The plant is 1.5–3 dm. high, much tufted at the base but with distinct rhizomes; the leaves conduplicate, 2–6 cm. long, the panicles compact, 2–5 cm. long. All parts of the plant contain much anthocyanin pigment. A very similar specimen from Tjust, Småland, Sweden⁶ has been annotated “nearest f. *humilis* Ehrh. according to Lindm. [transl.]”. Whether our collection from Cook County represents a plant native to the region, or an introduction of a northern European form is impossible to determine. The locality where it was collected was not entirely natural even twenty years ago, and weeds from northern Europe often flourish close to Lake Superior, where the summers are cool and damp. The fact that the plant has been found only in this one locality, a situation not in any

⁶ Coll. *C. E. Gustafsson*, June 16, 1918. (in Herb. Univ. of Minn.)

respect peculiar, makes us inclined to accept the second explanation. Unfortunately the place where this collection was made has since been pretty thoroughly destroyed by building operations in connection with a summer resort.

P. PRATENSIS, var. *ANGUSTIFOLIA* (L.) Sm., Fl. Brit. 105, 1800. PIGEON RIVER, *Butters & Rosendahl* 4623½; GRAND MARAIS, *Butters & Rosendahl* 4664. Roadsides, etc.; infrequent and introduced.

This is the narrow-leaved, narrower-panicled variety with the longer and much narrower basal leaves which has long passed simply as "*P. pratensis*" among American authors. It appears to be much commoner in this country than is typical *P. pratensis*. We do not agree with Lindman (Bot. Notiser (1926), p. 274) in his treatment of this variety as a species.

P. COMPRESSA L. Between BIRCH LAKE and POPLAR LAKE, *Butters & Abbe* 817; LIMA MOUNTAIN, *Butters & Abbe* 876; GRAND PORTAGE, *Butters & Abbe* 976; Mount Josephine, *Butters & Abbe* 1036 & 1038; GRAND MARAIS, *Butters & Rosendahl* 4654. Roadsides, along trails, rarely in undisturbed places.

This introduced plant is fairly common in Cook County, though probably less so than in the more settled parts of the state.

P. SALTUENSIS Fern. & Wieg., RHODORA 20: 122. 1918. PIGEON RIVER, *Butters & Rosendahl* 4623; MINERAL CENTER, *Butters & Rosendahl* 4596; CARRIBEAU RIVER, *Butters & Rosendahl* 4492. Moist, shady river-gorges and woodlands; infrequent.

This distinct species occurs sparingly in Cook County and westward as far as St. Louis County. All the collections were made in shady forest, and one each from Cook and St. Louis counties came from groves of hard maple.

P. SALTUENSIS, var. *MICROLEPIS* Fern. & Wieg., RHODORA 20: 124. 1918. MINERAL CENTER, *Butters & Rosendahl* 4582.

This collection from a cedar-spruce swamp is the only Minnesota specimen of this variety that we have seen.

P. PALUSTRIS L. *P. serotina* Ehrh. *P. triflora* Gilib.—SEA GULL LAKE, *Butters & Abbe* 915; between MOUNTAIN LAKE and WATAB LAKE, *Butters, Abbe & Abbe* 316; LIMA MOUNTAIN, *Butters & Abbe* 877; GRAND PORTAGE, *Rosendahl* 5981, *F. R. & J. S. Benner* 467; MOUNT JOSEPHINE, *Butters & Abbe* 1034, 1040, 1043,

1046, 1049; GRAND MARAIS, *T. S. Roberts* (no number); 12 miles west of GRAND MARAIS, *Butters & Abbe* 757. Moist roadsides and portage trails, margins of woods.

This species is very common throughout Cook County, as in most parts of Minnesota. It appears to be largely confined to low-lying moist areas, contrasting in this respect with the various forms of *P. nemoralis* and *P. glauca*, which are mostly cliff- and rock-plants.

P. NEMORALIS L.

An exceedingly polymorphic species. The typical European form has not been seen in Cook County. It is a rare adventive elsewhere in Minnesota. Either this or a very closely allied form occurs, apparently native, in Newfoundland and Labrador but elsewhere in North America it probably occurs only as an introduced plant. The following varieties are well-represented in Cook County, and are undoubtedly native:—

P. NEMORALIS, var. **interior** (Rydb.) stat. nov. *P. interior* Rydb., Bull. Torrey Bot. Club **32**: 604. 1905. GUNFLINT LAKE, *Butters & Buell* 377; CLEARWATER LAKE, *Butters & Buell* 416, *Butters, Burns & Hendrickson* 6, *Butters & Abbe* 961 A-F; LIMA MOUNTAIN, *Butters & Abbe* 865, 881; MOUNTAIN LAKE, *Butters, Abbe & Abbe* 256, 286, 308; *Butters, Burns & Hendrickson* 47, 67, 77; WEST PIKE LAKE, *Burns & Hendrickson* 182; JOHN LAKE, *Butters & Moore* 10817a; NORTH FOWL LAKE, *Butters, Abbe & Burns* 670; BRULE RIVER, *Butters & Rosendahl* 4543. Inland cliffs (slate and diabase), hill tops, dry rocks near shore of Lake Superior; common.

Of the several forms of *P. nemoralis* occurring in America this approaches closest to the European f. *vulgaris* with which it agrees in its numerous medium-sized greenish spikelets, having empty glumes with a green center, white scarious border, and usually rather distinct lateral nerves. It is distinguished by the prevailing shorter, broader, and less sharply acuminate empty glumes, its usually less freely branched panicle, and by its ligules, which are about 1 mm. high, and much more visible than in the European counterpart.

Since these differences are either decidedly trivial or wholly intergrading, it seems that it should be considered as a geographical variety rather than a species. Therefore we are adopting Rydberg's specific name in a new combination as no earlier

varietal name seems to be available. Apparently no exactly similar plant occurs in Europe, so that none of the oversupply of European varietal names is applicable. The synonym, *P. caesia* var. *strictior* A. Gray, cited by Hitchcock⁷ was originally applied to quite a different grass.⁸

In founding his *P. interior*, Rydberg gave no formal description but referred to a description and plate published by Scribner⁹ with the remark "His description and plate illustrates [sic] the American rather than the European plant." Rydberg contrasted the European *P. nemoralis* and his new species as follows: "The European plant is taller, with soft, flaccid leaves, ovate or lanceolate acute ligules, larger spikelets and narrowly lanceolate empty glumes which are tapering gradually at the apex and much narrower than the flowering glumes. The American plant is usually lower and stiffer, has rather firm leaves, truncate ligules, smaller spikelets, broader empty glumes, which are rather abruptly acuminate, and at least the second almost as broad as the flowering glumes." This statement is a curious mixture of a small amount of fact with considerable fiction. As to the supposed differences in habit, both plants are equally variable and the variations largely overlap. Indeed in his last work¹⁰ Rydberg describes *P. nemoralis* as having "stems 3–8 dm. long, slender" and *P. interior* with "stems slender, 3–6 dm. long," the former with "leaf-blades 5–15 cm. long," the latter "2–8 cm. long," not impressive differences, and rendered still less impressive when a casual examination of the many specimens in the Herbarium of the University of Minnesota annotated "*P. interior*" by Rydberg himself discloses several leaf-blades 10–11 cm. long. One can hardly maintain a variety, still less a species on such differences.

One is amazed and mystified by Rydberg's statement about the ligule of *P. nemoralis*, for that structure, instead of being "ovate or lanceolate, acute," is a narrow band, rarely a half millimeter in width, and with its free edge practically parallel to the base. Moreover all European botanists are united in describing it correctly as very short or even obsolete. What Rydberg was looking at and describing can only be surmised; it certainly was not the

⁷ Manual of the Grasses of the United States, p. 933. 1935.

⁸ See below, p. 12.

⁹ F. Lamson-Scribner, Bull. U. S. Div. Agrost. 17: 250. 1899.

¹⁰ Flora of the Prairies and Plains of Central North America, p. 118. 1932.

ligule of true *P. nemoralis*. The real difference in the ligules of the two forms lies in their size rather than in their shape. Both are equally truncate, but that of var. *interior* is two or three times as high as that of typical *P. nemoralis*.

In respect to the characters of the spikelets, it can first be said that their supposed difference in size is wholly imaginary. European material has spikelets varying from less than 2 mm. long (forma *micrantha* Hn.) to over 6 mm. (forma *Reichenbachii* A. & G. ex Lindm.). The spikelets of var. *interior* fall entirely within these limits and rarely approach either extreme. Second, there is no question that, in general, European specimens of *P. nemoralis* have longer, narrower, and sharper empty glumes than those of var. *interior*, but there is much variation and considerable overlapping in this respect. Occasional undoubtedly native American specimens have the glumes nearly as long and narrow as the European form.¹¹ A few such specimens have been collected in Cook County. Moreover, on most European specimens of *P. nemoralis* one can find occasional spikelets that are a good match for those of var. *interior*.

In his *Flora of the Prairies and Plains* (page 118–119) Rydberg suggests a difference in the lemmas of the two forms, which, however, proves to be entirely illusory. He says of the lemma of *P. nemoralis* "midrib and laterals sparingly pubescent", and of that of *P. interior*, "scabrous on the midnerve and lateral nerves". An examination of the two side by side shows them to be identical:—both have long silky hairs on the lower half of the mid-rib and lateral nerves, and more or less scabridity on the upper half.

A rather strong tendency in var. *interior* which appears to be hitherto unnoted, is that it most frequently has only two basal branches in the panicle, while European *P. nemoralis* most frequently has higher numbers of basal branches. That it is only a tendency, rather than a diagnostic character may be seen from the following table:—

¹¹ Apparently Rydberg tried to take care of certain of these cases by erecting another "species", *Poa subtrivialis* (Bull. Torrey Bot. Club 36: 535. 1909). We have seen no authentic specimens of this. Hitchcock (Man., p. 933. 1935) reduces it outright to synonymy under *P. interior*, and this would appear to be a reasonable disposition of it except for the statement in the original description "floral glumes . . . glabrous". However, for comments on Rydberg's description of the pubescence of lemmas see below in the text.

Number of basal branches	1	2	3	4	5	6	7
Percentage of occurrence							
<i>P. nemoralis</i> (European)	3	26	20	21	25	3	2
<i>P. n. var. interior</i>	3	61	20	8	6	2	0

Another tendency is seen in the prevailing pubescent rachis of the spikelet in European specimens, while in western specimens of var. *interior* the rachis is merely slightly scaberulous. However a few European specimens have the rachis nearly or quite glabrous, and in Minnesota there is a complete series between the two extremes, with this character varying wholly independently of any other.

In his *Manual of the Grasses of the United States* (p. 125. 1935), Hitchcock recognizes *P. interior* as a species, but judging from the range and synonyms given he extends the name to cover the following variety also. As here defined the var. *interior* ranges from the Lake Superior region westward and appears to be quite absent from farther east.

P. NEMORALIS, var. *MONTANA* Gaud., emend. Lindm., Bot. Notis. (1926): 274. *P. crocata* sensu Rydb., Fl. Pr. & Pl. 119 (1932), in part, perhaps not Michx. Fl. Bor.-Am. 1: 68 (1803). NORTH LAKE, Lange 8; CLEARWATER LAKE, Butters & Abbe 72; JOHN LAKE, Butters & Moore 10801; NORTH FOWL LAKE, Butters, Abbe & Burns 668; MOUNT JOSEPHINE, Butters & Rosendahl 6326, Butters & Abbe 184; MOUNT MAUD, Butters & Abbe 199, 202; CARRIBEAU RIVER, Butters & Rosendahl 4481, 4482. Inland cliffs (diabase and slate), dry tops of hills and bluffs both inland and near Lake Superior, river mouths; frequent.

A stiffly upright form, mostly 3–5 dm. high; leaves narrow, mostly conduplicate, ascending at a rather narrow angle, the uppermost borne above the middle of the stem, often quite close to the panicle; ligules 1–1.5 mm. long, nearly or quite glabrous, less truncate than in var. *interior*; panicle sparse and sometimes with very few spikelets, erect or slightly nodding at the top, 3–7 cm. long and rarely as much as 2 cm. wide, the branches ascending and usually closely appressed to the main axis, bearing 2–5 short-pedicelled or sometimes almost sessile spikelets above the middle, simple or rarely with a little branching toward the base of the panicle; the basal branches 2 (in 75 percent of the panicles) or 3 (in 19 percent), rarely 1, very rarely more than 3; spikelets mostly

2-3-flowered, 3-4 mm. long, the empty glumes narrowly lanceolate, sharply acuminate, the second about as long as the first lemma, red-purple sometimes with a narrow whitish border; the lemmas strongly tinged with red-purple and with an orange stripe toward the tip; the whole plant with purple coloration, especially the inflorescence, the exposed nodes (which are almost black), and the basal sheaths.

This variety differs from var. *interior* in its stiffer and lower growth, its slightly different ligules, its somewhat sparser panicles of dark purple spikelets in which the glumes tend to be a little longer and narrower than in var. *interior*. The rachis of the spikelet is usually scabrous-puberulent, but, as noted under the discussion of var. *interior*, some Minnesota specimens of that variety have a puberulent rachis. How much weight should be given to the purple color of the inflorescence is questionable, since it is known in other grasses to be the expression of a relatively simple Mendelian relationship, and furthermore its expression varies considerably with such ecological factors as temperature, moisture, and light. It should be further noted that certain apparently independent characters that have been used to distinguish "species" within this group are but the indirect effects of the presence or absence of anthocyanin. Thus in keying out "*P. nemoralis*", "*P. interior*" and "*P. crocata*", Rydberg uses the following entries¹²:—

"Spikelets green; second glumes with broad scarious margins and strong lateral nerves.

Second glume narrower than but fully as long as the lemma, acuminate.....16. *P. nemoralis*.

Second glume fully as wide, but shorter than the lemma, acute.....17. *P. interior*.

Spikelets usually purple-tinged; scarious margins of the glumes scarcely evident and the lateral nerves faint.....18. *P. crocata*."

On its face, this key looks fairly impressive, but it should be noted that the purple color occurs in the epidermal cells and thus, if present, suffuses what would otherwise be a broad scarious margin, and also renders the lateral nerves much less obvious. A glume of his no. 18, if boiled to get rid of the anthocyanin, looks just like one of no. 16.

It is with some hesitation that we adopt the name, var. *montana*, for this race of *P. nemoralis*. The name was originally

¹² Flora of the Prairies and Plains, p. 116.

applied to a plant of the Alps, apparently with exceedingly sparse panicles.¹³ Lindman emended the concept and extended it to cover a considerable group of Scandinavian plants, and he also applies the name to some Newfoundland specimens. Our Lake Superior specimens are very similar to some of the latter, those called "var. *montana* Gaud." by Lindman.¹⁴ On the average our specimens have slightly smaller spikelets, but there is much overlapping in this respect.

This race undoubtedly comprises a considerable portion of what Rydberg treats as "*Poa crocata* Michx."¹⁵ Whether it includes Michaux's original type is much more doubtful. A photograph of this type is in the Gray Herbarium, and has been carefully examined. It looks much like certain specimens of the race now under consideration, but certain parts of Michaux's description, such as "spiculis omnibus distincte pedicellatis" and "floribus . . . viridibus" do not apply. Piper, who examined the original specimen in 1911, considered it to be *P. triflora* Gilib. [*P. palustris* L.]¹⁶ and Hitchcock¹⁷ follows this interpretation, but the photograph looks much more like some form of *P. nemoralis*. This question can be settled only when world conditions allow a re-examination of the type.

P. GLAUCA Vahl, Fl. Dan. fasc. 17, p. 3. 1790. *P. caesia* Sm., Fl. Brit. 103. 1800. *P. caesia* var. *strictior* A. Gray, Man., ed. 5, 629. 1867. MOUNTAIN LAKE, Butters, Burns & Hendrickson 47a; PIGEON POINT, Butters, Abbe & Abbe 422, 424, Butters & Abbe 1009, 1012; CLARK'S BAY, Butters, Abbe & Abbe 388, 391; PORCUPINE ISLAND, Abbe & Abbe 576; SUSIE ISLAND, Abbe & Abbe 568; MOUNT JOSEPHINE, Butters & Abbe 1031, 1032, 1037; RESERVATION RIVER, Butters & Rosendahl 4567; GRAND MARAIS, Butters & Rosendahl 4505; THUNDER BAY DIST., ONT. (Boundary

¹³ Ascherson & Graebner, Synopsis der mitteleuropäischen Flora, 2: 409, say "Rispe nur mit wenigen (meist 5 bis 10) an (bis 2,5 cm.) langen Stielen stehenden Aerchen." Occasionally similar panicles occur in our Lake Superior specimens.

¹⁴ Fernald, Long & Gilbert 27410, springy mossy bank, Savage Cove, Straits of Belle Isle, northwestern Newfoundland, July 25, 1925. Wiegand & Pease 27413, glades near brook, Bear Cove, Straits of Belle Isle, northwestern Newfoundland, July 25, 1925; Wiegand, Gilbert & Hotchkiss 27421, turfy slopes of slaty hills, Little Quirpon, Quirpon Harbor, northwestern Newfoundland. These three specimens in the Gray Herbarium.

¹⁵ Judging from specimens annotated by Rydberg, and also from his citation of "*P. nemoralis* var. *strictior* Gray" (apparently an error for *P. caesia* var. *strictior*) as a synonym, his concept of *P. crocata* included also a considerable element which we are treating as *P. glauca*.

¹⁶ Torrey 13: 35. 1913.

¹⁷ Manual of the Grasses of the United States, p. 935. 1935.

Islands, Pigeon Bay), *Abbe & Abbe 592a*. Rocky shores and shingle beaches of Lake Superior, occasionally on inland cliffs; common.

A considerable number of specimens, nearly all from the shores of Lake Superior are a good match for European material of *P. glauca*. The type material of A. Gray's *P. caesia* var. *strictior* appears to belong here. Gray's original statement is that var. *strictior* is "6-12 inches high [against 6-20 inches for *P. caesia* of Europe] with a contracted grayish purple panicle of smaller flowers." Our Lake Superior specimens range from 6-20 inches (15-50 cm.) high and vary considerably in the size and color of the spikelets, though they always are more or less tinged with purple, sometimes strongly so. Some of them are a very close match for A. Gray's types which were kindly loaned to us by the Gray Herbarium.

P. GLAUCA, subsp. *CONFERTA* (Blytt) Lindm.¹⁸ LUCILLE ISLAND, *Butters, Abbe & Abbe 382*; GRAND MARAIS, *Wood 13*. Islands, shores and hills adjacent to Lake Superior; infrequent.

Butters, Abbe & Abbe 382, and *Wood 13* are an excellent match for Newfoundland plants¹⁹ thus determined by Lindman, and correspond well with his description of the Scandinavian plant.

¹⁸ C. A. Lindman, *Poa* in Otto R. Holmberg, *Skandinaviens Flora*, häfte 2, p. 208. Since this work is at least linguistically somewhat inaccessible, we append a translation of Lindman's description:

"subsp. *conferta* (Bl.) n. c. *P. conferta* Bl. *Norg. fl. I* (1861) p. 123. . . .

Low to middle high, straw and leaves green, very rarely gray-green but mostly gray-violet to bright red-violet like the leaf blades. Panicle compact. Spikelets large with broad, broadly margined glumes. Culms coarse, somewhat low, usually 2(-3) dm. high, somewhat arcuate, smooth. Leaves generally 2, quite broad, the edges often involute, spreading, the uppermost rarely above the middle of the culm; ligule long, even up to 3 mm. broad, and rounded. Panicle 3-5 cm. long, compact, cylindrical to narrowly ovate, rarely somewhat open and pointed, dense because of the upright branches and large spikelets. Spikelets 3-5 flowered, larger than in the head species. Glumes 3-4 mm. long, sometimes reaching the top of the first lemma, the apex grayish or even blackish red-violet. Outer lemmas similar with a strong white-hairy line close to the edge, wider and with wider thin margins than in the head species, and with a wider orange-yellow cross-band. 2 7.

var. *laxiuscula* (Bl.) n. c. *P. aspera* v. *laxiuscula* Bl. *Norg. fl. I* (1861) p. 122.—*Fig. Fl. D. 2946.*

Straw more pliable and slender, sometimes very fine. Cauline leaves often 3, long, narrow, less spreading, the uppermost above the middle of the culm. Ligule about 1 mm. long. Panicle more simple with fewer and finer branches, fewer and smaller spikelets, often spike-like with 1-spikeleted branches. Glumes smaller, relatively straighter and narrower as well as generally lighter violet. Includes some distinguishable forms, which, however, all more or less show approach to *P. nemoralis*."

¹⁹ *Fernald, Wiegand, Pease, Long, Griscom, Gilbert & Hotchkiss 27408*, dry limestone barrens, northern half of Burnt Cape, Pistolet Bay, northwestern Newfoundland, July 17, 1925; *Fernald & Long 27420*, peaty limestone barrens, southern half of Burnt Cape, Pistolet Bay, northwestern Newfoundland, Aug. 5, 1925. These specimens in the Gray Herbarium.

It is separable from typical *P. glauca* by its larger, intensely colored spikelets in narrow, dense panicles, and by the purplish coloration of the whole plant.

P. GLAUCA, subsp. *CONFERTA*, var. *LAXIUSCULA* (Blytt) Lindm.¹⁸
MOUNT JOSEPHINE, *Nielsen & Egler* 2051.

This collection is taller and somewhat finer and more leafy than other specimens of subsp. *conferta*. It appears to belong to this variety.

P. GLAUCA Vahl, subsp. *GLAUCANTHA* (Gaud.) Lindm., Bot. Notis. (1926): 275. WATAB LAKE, *Butters, Abbe & Abbe* 241; CLEARWATER LAKE, *Butters & Wherry* (June 29, 1935), *Butters, Burns & Hendrickson* 123, *Burns & Hendrickson* 156; LITTLE CARIBOU LAKE, *Burns & Hendrickson* 410; ROCKY LAKE, *Burns & Hendrickson* 378; CANOE LAKE, *Burns & Hendrickson* 381; MOUNTAIN LAKE, *Butters, Abbe & Abbe* 258, *Butters, Burns & Hendrickson* 66; MACFARLAND LAKE, *Burns & Hendrickson* 372; SOUTH FOWL LAKE, *Burns & Hendrickson* 282; ROYAL LAKE AND RIVER, *Burns & Hendrickson* 240, 358; PIGEON POINT, *Butters, Abbe & Abbe* 422a, *Abbe & Abbe* 590, *Butters & Abbe* 1007, 1013; LUCILLE ISLAND, *Butters & Abbe* 350; LONG ISLAND, *Abbe & Abbe* 547; SAILBOAT ISLAND, *Abbe & Abbe* 535; MOUNT JOSEPHINE, *Butters & Abbe* 164, 1041. Inland cliffs (diabase and slate); islands, shore rocks and hills adjacent to Lake Superior; common.

This grass appears to be quite common in the region along the Canadian border. Our specimens are an excellent match for certain specimens so determined by Lindman for the region of the Gulf of St. Lawrence²⁰ and also for a Norwegian specimen²¹ determined by Lindman. They are rather coarse and stiff plants 4–8 dm. high, tufted, with culms often markedly geniculate at the lower nodes. The bluish-green leaves are about 2 mm. wide, the uppermost borne far below the middle of the culm. The panicle is profuse, and the spikelets in all the Minnesota specimens are large, (4)5–6(7) mm. long and mostly 3–4(6)-flowered. Some of the spikelets are almost or quite sessile with

²⁰ *Fernald & Collins* 896, Pointe aux Corbeaux to Cape Caribou, Bic, July 11, 1907; *Fernald & Long* 27423, Savage Cove, Straits of Belle Isle, Aug. 29, 1925; *Fernald, Wiegand, Long, Gilbert & Hotchkiss* 27414, Bard Harbor Hill, July 27, 1925.—All these at the Gray Herbarium.

Some other specimens in the Gray Herbarium similarly annotated as "*Poa glauca* subsp. *glaucantha* fide Lindm." have smaller spikelets, not at all agglomerated, and appear quite different from any Minnesota plants that we have seen.

²¹ Otto R. Holmberg, no number, Nordland: Rombaksbotten, 22. VII. 1926,—in the C. E. Gustafsson Collection, Herbarium of the University of Minnesota.

the result that two or three adjacent spikelets may form a glomerule-like cluster.

This entity, originally described as a species, and long regarded as a variety of *P. nemoralis* was shifted into *P. glauca* as a subspecies by Lindman with the comment that he was uncertain whether it was not worthy to be regarded as a species.²² As it occurs in northeastern Minnesota this grass appears to be quite distinct from typical *P. glauca*, and also from the forms of *P. nemoralis*, although there is evidence that it hybridizes with the latter. It is most abundant on north-facing cliffs along the Border Lakes, but occurs also, somewhat reduced in size, along the shores of Lake Superior. Normal plants in the latter location are about 4 dm. high. A considerable number of even more stunted specimens have been collected there, but they all show signs of fungus infection which seems to have interfered with both their growth and with their fruiting. See PLATE 1052, FIGS. 1-3.

× *P. tormentuosa*, hybr. nov. (*P. glauca*, subsp. *glaucantha* × *P. nemoralis*). Tab. 1052, fig. 7-9. Culmi laxi, tenues ut in *P. nemorali* var. *interiore*, infra medium foliosi ut in *P. glauca* subsp. *glaucantha*; folia ca. 1 mm. lata, ligulis forma, magnitudine pubescentiaque variabilibus; pedunculus paniculae nudus 2-3 dm. longus 0.5 mm. latus; spiculae parvae ut in *P. nemorali* var. *interiore*, 2-3-flores, pedicellatae, 3-4(5) mm. longae, lemmatibus erosis subobtusis ut in *P. glauca* subsp. *glaucantha*; pollen plerumque abortivus; fructus raro gestus.—Typus *Butters, Burns & Hendrickson 2* in herb. Univ. Minnesota. HUNGRY JACK LAKE, *Burns & Hendrickson 424*; CLEARWATER LAKE, *Butters, Burns & Hendrickson 2, Butters & Abbe 961G*; LITTLE CARIBOU LAKE, *Burns & Hendrickson 410*; EAST PIKE LAKE, *Burns & Hendrickson 233*; SOUTH FOWL LAKE, *Burns & Hendrickson 274, 303*; ROYAL RIVER, *Burns & Hendrickson 336*; PIGEON POINT, *Butters & Abbe 1008, 1010, 1011, 1014*. Cliffs (slate and diabase) mostly along the border lakes; occasional.

In working over our Cook County specimens, some dozen were segregated, which agreed remarkably well with one another, but could not be identified with any of the recognized species or varieties. As they combine quite remarkably the characters of *P. glauca*, ssp. *glaucantha* with those of *P. nemoralis*, var. *interior*, and, as they were all collected in a region where both of these

²² Lindman, C. A. M., Bot. Notiser (1926): 275.

grasses are very common, it occurred to us that they might well be hybrids. This interpretation is strengthened by the fact that the supposed hybrids are largely sterile. Though most of the specimens are thoroughly mature only a very few ripe seeds have been found on them—less than an average of one per plant. Whether these seeds are viable has not been determined, but they appear normal, and they at least suggest the possibility of a few second generation hybrids or back-crosses with one of the parents. The variability of the character of the ligule suggests the same possibility from the genetical standpoint.

In addition to prevalent failure to produce seeds, the pollen of the supposed hybrid has been found to be very poor. Over half of the pollen grains are wholly empty, and the rest are variable in size with numerous dwarf and giant grains. Less than one-fourth of the grains appear reasonably normal under the microscope. In marked contrast to this both of the supposed parents have uniformly good pollen.

The following table presents the characters of the putative parents and the supposed hybrid in parallel columns:—

	<i>P. glauca</i> ssp. <i>glaucantha</i>	× <i>P. tormentuosa</i>	<i>P. nemoralis</i> var. <i>interior</i>
<i>Culms</i>	Coarse and stiff Leafy below the middle, the panicle borne on a naked peduncle 2–5 dm. long and ca. 1 mm. thick	Lax and very fine Leafy below the middle, the panicle borne on a naked peduncle 2–3 dm. long and ca. 0.5 mm. thick	Lax and fine Leafy above the middle, the naked peduncle 1–1.5(2) dm. long, and ca. 0.5 mm. thick
<i>Nodes</i>	Covered or slightly exposed	Covered or slightly exposed	Exposed
<i>Leaves</i>	About 2 mm. wide	About 1 mm. wide	1–2 mm. wide
<i>Ligules</i>	1–2 mm. high, narrowed upward, tending to split with age; the back glabrous to slightly scaberulous	Variable, mostly like ssp. <i>glaucantha</i> ; in one specimen wholly like var. <i>interior</i> , in another like var. <i>interior</i> in shape but glabrous	About 1 mm. high, truncate; the back ± scabrous-puberulent, usually strongly so
<i>Spikelets</i>	Large, (4) 5–6 (7) mm. long; (2) 3–4 (6)-flowered; some almost sessile	Small, 3–4 (5) mm. long; 2–3-flowered; pedicelled	Small, 3.5–4.5 mm. long; 2–3 (4)-flowered; pedicelled

	<i>P. glauca</i> ssp. <i>glaucantha</i>	× <i>P. tormentuosa</i>	<i>P. nemoralis</i> var. <i>interior</i>
<i>Lemmas</i>	Somewhat blunt, erose	Somewhat blunt, erose	Acutish to somewhat rounded, not erose
<i>Pollen</i>	Good	Very poor	Good
<i>Fruiting</i>	Abundant	Very little	Abundant

We have seen specimens of this hybrid only from extreme northern Cook County, a region where both of the parents abound. It is scarcely to be expected far either to the west or to the east of this region, since this appears to be near the eastern limit of one of the parents and the western limit of the other. Doubtless it occurs northward into Ontario since some of our collections come from just south of the border and exactly similar country occurs for some distance northward.

P. scopulorum spec. nov. (TAB. 1051, FIG. 1-8) Culmi gracillimi laxi arcuati (17) 30-40 (42) cm. alti laeves vel raro ad paniculam scabriusculi, ad dimidiam foliosi conferti innovationibus normaliter intravaginalibus crebris (surculis rhizomaticis nullis) vaginis basalibus stramineis laxis tenuissimis fragilibus marcescentibus venis persistentibus. Folia culmea 2-4 laxa planiuscula plerumque laevia (raro apicem versus scabriuscula) virentia (3) 5-8 cm. longa (0.5) 1-2 mm. lata ad basin dehinc gradatim angustata ad apicem acuminatum, ligulis 1-2 mm. longis ovatis plus minusve laceris vix decurrentibus glabris. Paniculae 2.7-5.4 cm. longae plus minusve contractae flexiusculae ramis instructae vulgo binis imparibus in nodo singulo ad 1.5 cm. longis adscendentibus vel subpatulis laevibus vel scabriusculis spiculas 1-3 gerentibus. Spiculae ex albo virentes (2.8) 3.5-5.5 (6.0) mm. longae floribus 2-4 glumis acuminatis subaequalibus in carina scabriusculis (raro laevibus) per totum scariis venis obscuris, gluma I anguste lanceolata, gluma II minus angusta valvulam primam aequante; valvulis tenuibus scariis ad apicem rotundatis vel subtruncatis, leviter erosis in dimidia inferiore carinae et triente inferiore nervorum lateralium sericeis in dimidio superiore carinae scabris, inter nervos sparse scabriusculis ad basim araneo minimo instructis; palearum carinis quasi pectinatis dentibus usque ad 70 μ longis vix crebris instructis inter quos dentes breviores sparguntur. Antherae 0.95-1.6 mm. longae flavae oblongae granulis pollenis optimis impletae.

Specimens examined, all from Cook County, MINNESOTA: *Butters & Abbe* 135, gabbro cliffs, Winchell Lake, June 27, 1936;

Butters & Abbe 97, slate and diabase cliffs overlooking Clearwater Lake, June 22, 1936 (TYPE); *Butters & Abbe* 950, upper stable talus at foot of cliff 2B, Clearwater Lake, Aug. 6, 1944 (TOPO-TYPE); *Butters & Abbe* 87, first cliff, Clearwater Lake, June 22, 1936; *Butters & Buell* 471, high on cliff south of Clearwater Lake, July 17, 1932; *Butters, Abbe & Abbe* 261, cliff east of portage, south side of Mountain Lake, July 4, 1937; *Butters, Burns & Hendrickson* 56, on cliff, south side of west end of Mountain Lake, July 7, 1938; *Butters & Abbe* 184a, crevices in diabase, top of Mount Josephine, near Grand Portage, June 29, 1936.—Slate, diabase and gabbro cliffs; occasional.

This species appears to belong to the *Poa laxa* group (the section *Oreinos* sensu Nannfeldt²³) but in several respects it is more or less aberrant. It does not have the very small anthers (0.6–1.0 mm. long) that are characteristic of all the other species of the group except the Transsylvanian *P. Nyaradyana* Nannf. Neither does it have the keels of the palea as strictly pectinate as in *P. laxa* Haenke or as in *P. Fernaldiana* Nannf. Under a moderate magnification the keels appear pectinate, but under the compound microscope the long teeth are seen to have shorter teeth interspersed between them, not as crowded as in *P. glauca* but more so than in *P. laxa*. On the other hand the Scandinavian representative of the group, *P. flexuosa* J. E. Smith, has the paleal keels almost identical with those of *P. scopulorum* and it is admitted without question by Nannfeldt to the section *Oreinos*.

The branches of the panicle may be quite as glabrous as is usual in the other species of *Oreinos*, but they vary from this condition through scattered scabridity to a fairly strongly scabrous condition which is more characteristic of *P. glauca* and its relatives. The ligules of *P. scopulorum* are the shortest described for any species assigned to this section, but they are otherwise quite normal.²⁴ As a whole the plant is rather larger than plants of the other species of the section.

In contrast to these more or less aberrant features are a considerable number of characters in which it is strictly comparable with the other species of *Oreinos*. Like all the group it has the culms closely bunched without any tendency to form even the

²³ *Symbolae Bot. Upsalienses* 5: 1935.

²⁴ *P. Pattersoni* Vasey of the Rocky Mountains, however, has still shorter ligules. Despite its usually involute, somewhat stiffish leaf-blades it appears to be in all other respects a very normal member of this section, although it was not included here by Nannfeldt.

shortest of runners. The innovations appear to be strictly intravaginal in origin, though this may become somewhat obscured by the later disintegration of the sheaths. The basal sheaths themselves are very thin, loose, and marcescent, eventually disintegrating and leaving only a few strong veins.

The soft, flaccid leaves tapering gradually to a very narrow point are also thoroughly characteristic, as well as the rather long sheaths of the cauline leaves, usually concealing the nodes, but occasionally leaving them slightly exposed.

The spikelets are wholly normal for the group, though practically without any of the purple color found in most species. Both the glumes and the lemmata are very thin and translucent, and their veins are quite obscure. The pubescence of the lemma reaches about as far up the keel and lateral nerves as in *P. laxa*,²⁵ while the individual hairs are like those of *P. flexuosa* (tapering to an acuminate tip)²⁶.

The panicle varies somewhat in our different collections. In one (*Butters & Abbe* 87, cf. PL. 1051, FIG. 1) the branches are rather spreading, in all the others (cf. PL. 1051, FIGS. 3 and 7) they are strongly ascending or appressed. As the branches themselves are short this makes less alteration in the appearance of the panicle than would otherwise be the case. Occasionally the branches are solitary, but for the most part they occur in pairs, and then one will commonly bear a single spikelet, and the other either 2 or 3 spikelets.

We have seen eight collections of this plant, all from steep, usually north-facing cliffs of slate, diabase, and in one case gabbro, along the lakes of northern Cook County. Nannfeldt points out that the species of the section *Oreinos* are essentially alpine rather than arctic. *P. flexuosa* barely gets inside the Arctic Circle in the mountains of Norway. The occurrence of *P. scopulorum* then, in a lowland habitat in latitude 48° N. is quite exceptional, but can be explained by the peculiarities of the habitat. The cliffs on which it occurs are steep enough to give a very fair imitation of alpine conditions: they are too steep for the growth of trees and rise high above the wooded talus at the base; on account of the north exposure they receive scarcely any

²⁵ Cf. Nannfeldt, loc. cit., p. 46.

²⁶ Ibid, p. 48.

direct sunlight except for brief periods in the early morning or late afternoon, but have full indirect illumination by sky light at all times; they have perfect drainage; the soil is largely half-disintegrated rock in crevices of the more stable ledges and is often quite unstable; the climate combines extremely severe winters with summers of quite moderate temperatures. Most of the cliffs seem to have been but little interfered with during the Wisconsin glaciation, though there is ample evidence that the whole country was thoroughly glaciated earlier in the Pleistocene.

On the sixth of August, 1944, we re-visited the type locality of *P. scopulorum* with the express purpose of checking on its appearance and distinctness in the field, having previously become familiar with it in the herbarium. We motored over to the west end of Clearwater Lake from our comfortable cottage at Stoltz's on Poplar Lake, rented a canoe from Boostrom's and paddled east on a fine, brisk, sunshiny day past the now familiar shaded cliffs on the south side of Clearwater Lake. The first cliff (cliff 1) we were sorry to see had still far too evident the scars of the fire of August, 1936, and we congratulated each other on having been so fortunate as to have collected over it earlier that summer. Paddling on a mile or so further we passed cliff 2A, nearly overgrown with forest and separated by but a narrow draw from the much larger and more majestic cliff 2B. We drew up in front of cliff 2B and rested on our paddles just long enough to enjoy its magnificence, and to note that there had been several new falls from the crest, so that there were raw gashes in its face and fresh rocks among the lichen-covered boulders forming the high talus rising 200 ft. out of the lake. As usual we experienced some difficulty in finding a good place to draw the canoe ashore, because of the occasional, slippery, half-floating logs along shore, the dense marginal tangle of evergreens, and the boulders so spaced that the moss between them hid fine "booby traps" from ready detection. Gathering together vascula, collecting picks and lunch we began the climb up through the fringe of woods along the bottom of the talus and soon emerged on to the open talus upon which the forest has not as yet encroached. Great blocks of diabase three, four, and five feet on a side, well covered with moss, but often insecurely balanced, form the lower part of